INDOOR AIR QUALITY ASSESSMENT

Georgetown Senior/Middle School
11 Winter Street
Georgetown, Massachusetts

Prepared by:
Massachusetts Department of Public Health
Bureau of Environmental Health Assessment

March, 2002

Background/Introduction

At the request of Mike Donahoe, Facilities Director, Georgetown Public Schools, the Massachusetts Department of Public Health (MDPH), Bureau of Environmental Health Assessment (BEHA) provided assistance and consultation regarding indoor air quality concerns at the Georgetown Senior/Middle School, Georgetown, MA. On December 19, 2001, a visit was made to the school by Cory Holmes, Environmental Analyst for BEHA's Emergency Response/Indoor Air Quality (ER/IAQ) program, to conduct an assessment. Mr. Holmes was accompanied by Suzan Donahue, Research Assistant, ER/IAQ and Mr. Donahoe during the assessment. Reports of exacerbation of respiratory symptoms attributed to potential mold exposure prompted this assessment.

The school is a multi-level brick building originally constructed in 1962. An addition was made in 1969. The building was completely renovated in the late 1990's, which included an upgrade of mechanical ventilation components and a new roof. The top floor contains the majority of middle school classrooms; the second floor contains high school and several middle school classrooms, a computer lab and media center. The first floor is made up of the auditorium, gymnasium, office space, TV studio, photography, art room, science classrooms, kitchen and cafeteria. Windows throughout the building are openable.

It was reported by Mr. Donahoe that the building had previously had a problem with water penetration through the building envelope, which caused water damage and microbial growth to building materials [e.g., gypsum wallboard (GW)]. The problem was identified as missing/incomplete caulking at the wall junction on the exterior façade of the building. Reportedly these areas were re-caulked. Water-damaged building materials were removed and replaced and wall cavities were allowed to dry out over a six month period.

Methods

Air tests for carbon dioxide, temperature and relative humidity were taken with the TSI, Q-Trak, IAQ Monitor, Model 8551. A visual inspection of the exterior of the building as well as wall cavities and areas with historic water damage on the interior were evaluated for continued water damage and microbial growth. Moisture content in GW was measured with a Delmhorst, BD-2000 Model, Moisture Detector with a Delmhorst Standard Probe.

Results

The school houses both middle and high school students grades 6-12. It has a student population of approximately 700 and a staff of approximately 100. Tests were taken during normal operations at the school and results appear in Tables 1-8.

Discussion

Ventilation

It can be seen from the tables that carbon dioxide levels were elevated above 800 parts per million parts of air (ppm) in forty-four of sixty-six areas surveyed, indicating inadequate ventilation in a number of areas of the school. It is important to note that a number of areas were sparsely populated or had open windows, which would be expected to contribute to reduced carbon dioxide levels. The MDPH approach to resolving indoor air quality problems in schools is generally two-fold: 1) improving ventilation to dilute and remove environmental pollutants and 2) reducing or eliminating exposure opportunities from materials that may be adversely affecting indoor air quality.

Fresh air in classrooms is supplied by a unit ventilator (univent) system (see Picture 1). Univents draw air from outdoors through a fresh air intake located on the exterior walls of the building (see Picture 2) and return air through an air intake located at the base of each unit (see Figure 1). Fresh air and return air are mixed, filtered, heated and provided to classrooms through a fresh air diffuser located in the top of the unit. Univents were found deactivated in a number of classrooms (see Tables/Picture 3). Obstructions to airflow, such as books, papers, and desks were seen in a number of classrooms (see Picture 4). In order for univents to provide fresh air as designed, they must be unblocked and remain free of obstructions. Importantly, these units must be activated and allowed to operate.

The mechanical exhaust ventilation system consists of ceiling and wall-mounted exhaust vents. Little or no draw of air was detected in several classrooms (see Tables), which can indicate that either the exhaust ventilation was turned off, or that rooftop motors were not functioning. A number of exhaust vents were obstructed by tables, chairs, boxes and other items (see Picture 5). The location of some exhaust vents can also limit exhaust efficiency when the classroom hallway door is open (see Picture 6). When a classroom door is open, exhaust vents will tend to draw air from both the hallway and the classroom. The open hallway door reduces the effectiveness of the exhaust vent to remove common environmental pollutants from classrooms. Without removal by exhaust ventilation, normally occurring environmental pollutants can build up and lead to indoor air complaints.

Science classrooms are equipped with three separate ventilation controls (see Picture 7). One control activates an air conditioning system during warm weather months; a second control, similar to other classrooms, controls the unit ventilator; and a third control activates an additional exhaust vent installed to facilitate ventilation during science experiments.

To maximize air exchange, the BEHA recommends that both supply and exhaust ventilation operate continuously during periods of school occupancy. In order to have proper ventilation with a mechanical supply and exhaust system, the systems must be balanced to provide an adequate amount of fresh air to the interior of a room while removing stale air from the room. The date of the last balancing of these systems was reportedly conducted in 1998. It is recommended that HVAC systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994).

The Massachusetts Building Code requires a minimum ventilation rate of 15 cubic feet per minute (cfm) per occupant of fresh outside air or have openable windows in each room (SBBRS, 1997; BOCA, 1993). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens, a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air (ppm). Workers may be exposed to this level for 40 hours/week, based on a time-weighted average (OSHA, 1997).

The Department of Public Health uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches.

Temperature measurements ranged from 66^{o} F to 77^{o} F, which were below the BEHA recommended comfort range in a number of areas. The BEHA recommends that indoor air temperatures be maintained in a range of 70^{o} F to 78^{o} F in order to provide for the comfort of building occupants. A number of temperature control complaints were expressed to BEHA staff. In several areas, univents were deactivated or covered to reduce airflow as a result of temperature fluctuations (as shown in Pictures 3 & 4). It is difficult to control temperature and maintain comfort without operating the HVAC equipment as designed. In many cases concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an adequate fresh air supply.

The relative humidity measured in the building ranged from 24 to 36 percent, which was below the BEHA recommended comfort range. The BEHA recommends a comfort range of 40 to 60 percent for indoor air relative humidity. Relative humidity levels in the building would be expected to drop during the winter months due to heating. The sensation of dryness and irritation is common in a low relative humidity environment. Low relative humidity is a very common problem during the heating season in the northeast part of the United States.

Microbial/Moisture Concerns

In order for building materials to support mold growth, a source of water is necessary. Identification and elimination of water moistening building materials is necessary to control mold growth. Along with visual inspection, identification of GW with increased moisture content over normal concentrations may indicate the possible presence of mold growth. Identification of the location of GW with increased moisture levels can also provide clues concerning the source of water supporting mold growth.

The BEHA assessment occurred after several days of intermittent rain. At the time of the BEHA assessment, no elevated moisture readings were measured; nor was standing water or visible mold growth observed in the wall cavity (see Picture 8). As stated previously, the source of water penetration was reportedly eliminated by re-caulking exterior wall junctions; all water damaged building materials were removed and replaced; and all non-porous areas effected by water penetration were dried out and disinfected.

A number of rooms had water-stained ceilings and ceiling tiles, which are evidence of roof and/or plumbing leaks (see Picture 9). Water-damaged ceiling tiles can provide a source of mold and mildew growth and should be replaced after a leak is discovered.

Plants were noted in several classrooms. Plants can be a source of pollen and mold, which can be respiratory irritants to some individuals. Plants should be properly maintained and equipped with drip pans. Plants should also be located away from air diffusers to prevent aerosolization of dirt, pollen or mold (see Picture 10 & 11). In hallways, water fountains were observed mounted over carpeted floors (see Picture 12). Leakage or overflow can cause water damage to carpeting and potentially lead to microbial growth. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends that carpeting be dried with fans and heating within 24 hours of becoming wet (ACGIH, 1989). If carpets are not dried within this time frame, mold growth may occur. Once mold has colonized porous materials, they are difficult to clean and should be removed.

An old refrigerator was located in a prep-room adjacent to science classroom 1320. Mold growth was noted on the rubber gasket around the door. It was reported that this refrigerator is only used on rare occasions to store water samples for classroom experiments. This refrigerator should be properly cleaned and/or have the door gasket replaced to prevent indoor air quality complaints associated with mold growth.

Several areas had aquariums; room 1190 contained a fish tank that was green with algal growth. Aquariums should be properly maintained to prevent microbial/algal growth as they can emit unpleasant odors into the classroom.

Other Concerns

Several other conditions were noted during the assessment, which can affect indoor air quality. Classroom 1320 contained a chemical hood in which a number of materials were being stored. It was reported that there was an alarm malfunction making the chemical hood inoperable. BEHA staff confirmed that the exhaust fan for this chemical hood was not operating during the assessment. The chemical hood exhaust ventilation should be operational at all times that materials are within this equipment to remove off-gassing vapors and odors. In addition, stock bottles of chemicals should be returned to chemical storage areas once experiments have been completed.

The chemical storage area is located in a room adjacent to science classroom 1320. A number of conditions were observed in this room that could have a negative impact on indoor air quality. The following conditions are examples of improperly stored chemicals seen in this area.

1. A number of materials appeared to be of extreme age.
2. Reuse of original bottles for storage of other chemicals was apparent.
3. Shelves do not have guardrails to prevent accidental breaks of chemical containers.
4. A number of bottles labeled by chemical formula and not name were noted. Containers should be labeled with the chemical name of its content so an untrained person can identify the material in the case of an emergency.

Several classrooms contained dry erase boards and dry erase board markers. Materials such as dry erase markers and dry erase board cleaners may contain volatile organic compounds (VOCs), (e.g. methyl isobutyl ketone, n-butyl acetate and butyl-cellusolve) (Sanford, 1999), which can be irritating to the eyes, nose and throat.

Also of note was the amount of materials stored inside some classrooms. Items were seen piled on windowsills, tabletops, counters, bookcases and desks. The large amounts of items stored in classrooms provide a source for dusts to accumulate. These items, (e.g. papers, folders, boxes, etc.) make it difficult for custodial staff to clean. Household dust can be irritating to eyes, nose and respiratory tract. Items should be relocated and/or cleaned periodically to avoid excessive dust build up.

Conclusions/Recommendations

In view of the findings at the time of the inspection, the following recommendations are made to improve general indoor air quality:

1. Re-seal observation holes in GW in classrooms. Inspect areas previously impacted by water penetration (e.g., exterior caulking, interior GW) periodically to ensure building envelope is maintained.
2. Operate mechanical ventilation during periods of school occupancy to maximize air exchange. School staff should be encouraged not to deactivate classroom univents.
3. Examine rooftop exhaust motors for proper function. Repair/replace belts and parts as necessary.
4. Remove all obstructions from univents and mechanical exhaust vents to facilitate airflow.
5. Faculty and staff are encouraged to report any complaints concerning temperature control/preventive maintenance issues to the facilities department in the form of a

work order (See Attachment). These work orders are reportedly provided by the school maintenance staff and/or administration.

6. Consider consulting a heating, ventilation and air conditioning (HVAC) engineering firm concerning the balancing of ventilation systems and the calibration of univent fresh air control dampers school-wide.
7. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a HEPA filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces is recommended. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).
8. Repair any existing water leaks and replace any remaining water-stained ceiling tiles. Examine the areas above these tiles for mold growth. Disinfect areas of water leaks with an appropriate antimicrobial as needed.
9. Ensure plants are equipped with drip pans. Examine drip pans periodically for mold growth and disinfect with an appropriate antimicrobial where necessary. Move plants away from air diffusers in classrooms.
10. Place tile or rubber matting underneath water coolers/fountains in carpeted areas.
11. Clean and maintain aquariums and animal cages to prevent bacterial/mold growth and/or odors.

12. Relocate or consider reducing the amount of materials stored in classrooms to allow for more thorough cleaning. Clean items regularly with a wet cloth or sponge to prevent excessive dust build-up.
13. Evaluate science chemical flow hoods in order to determine proper function to contain vapors in accordance with ANSI/ASHRAE 110-1995 section 6.
14. Clean the refrigerator of mold growth. Replace door gasket as necessary.

References

ACGIH. 1989. Guidelines for the Assessment of Bioaerosols in the Indoor Environment. American Conference of Governmental Industrial Hygienists, Cincinnati, OH.

ASHRAE. 1995. American Society of Heating, Refrigeration and Air Conditioning Engineers, Method of Testing Performance of Laboratory Fume Hoods. 110-1995.

BOCA. 1993. The BOCA National Mechanical Code/1993. 8th ed. Building Officials and Code Administrators International, Inc., Country Club Hill, IL. Section M-308.1.1.

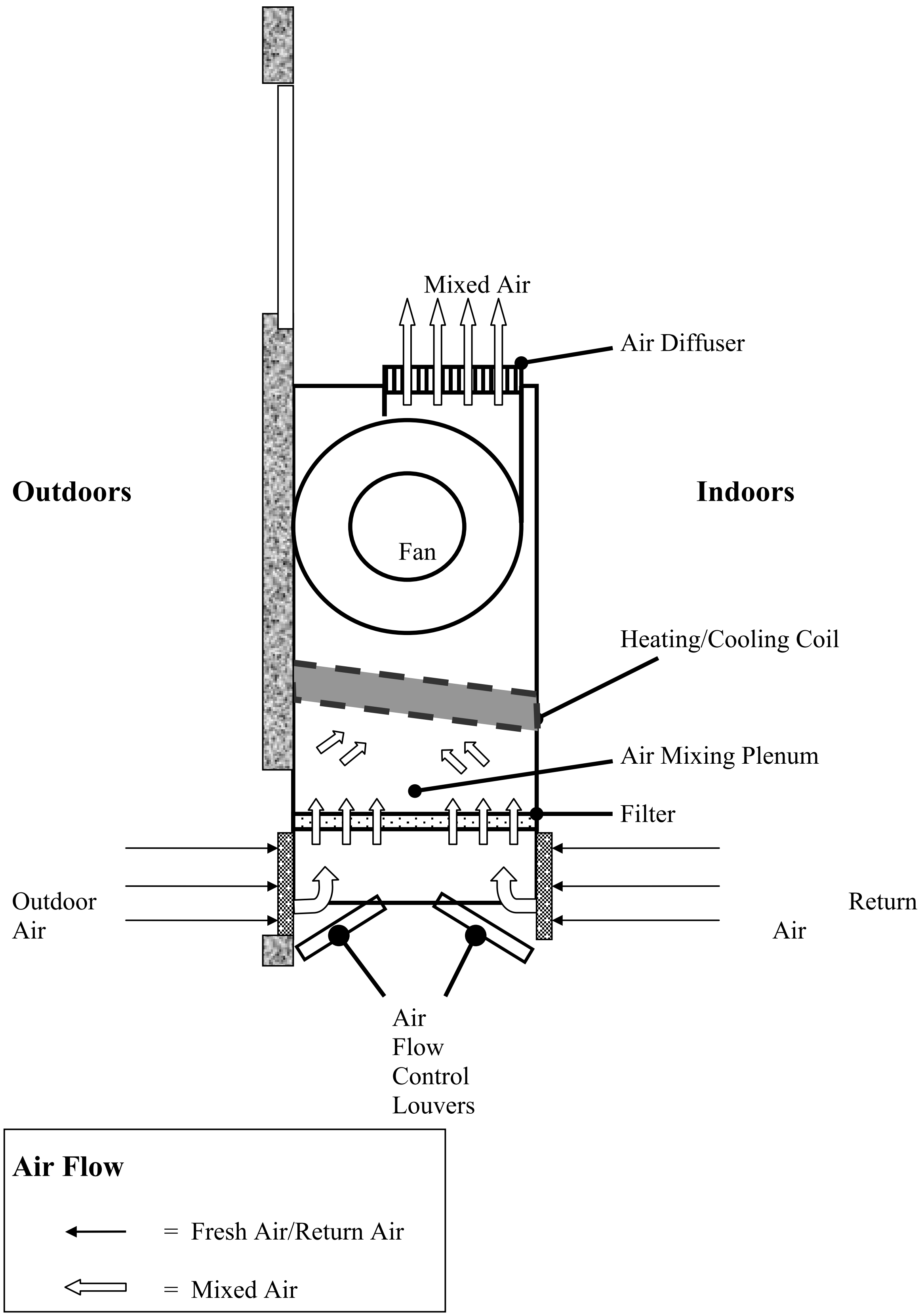
OSHA. 1997. Limits for Air Contaminants. Occupational Safety and Health Administration. Code of Federal Regulations. 29 C.F.R 1910.1000 Table Z-1-A.

Sanford. 1999. Material Safety Data Sheet (MSDS No: 198-17). Expo® Dry Erase Markers Bullet, Chisel, and Ultra Fine Tip. Sanford Corporation. Bellwood, IL.

SBBRS. 1997. Mechanical Ventilation. State Board of Building Regulations and Standards. Code of Massachusetts Regulations. 780 CMR 1209.0

SMACNA. 1994. HVAC Systems Commissioning Manual. 1st ed. Sheet Metal and Air Conditioning Contractors' National Association, Inc., Chantilly, VA.

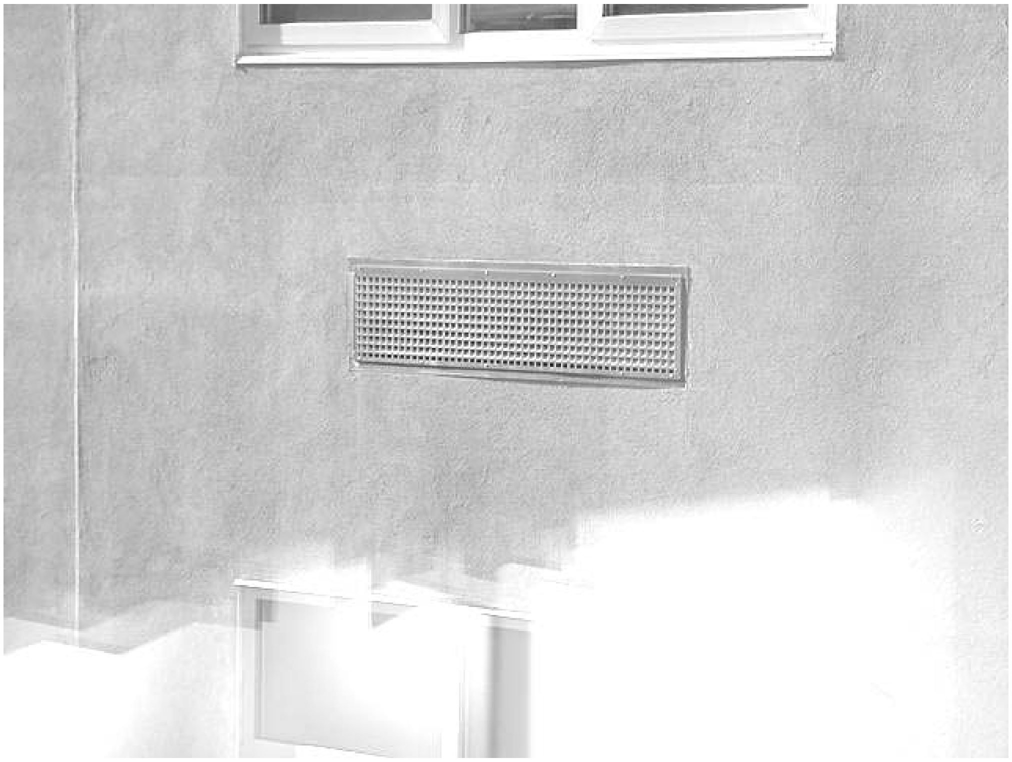
Figure 1 **Unit Ventilator (Univent)**



Picture 1

Classroom Univent

Picture 2



Univent Fresh Air Intake on Exterior of Building

Picture 3

Deactivated Classroom Univent, Note Access Panel Removed

Picture 4

Books on Univent Air Diffuser Obstructing Airflow, Also Note Plant on Univent

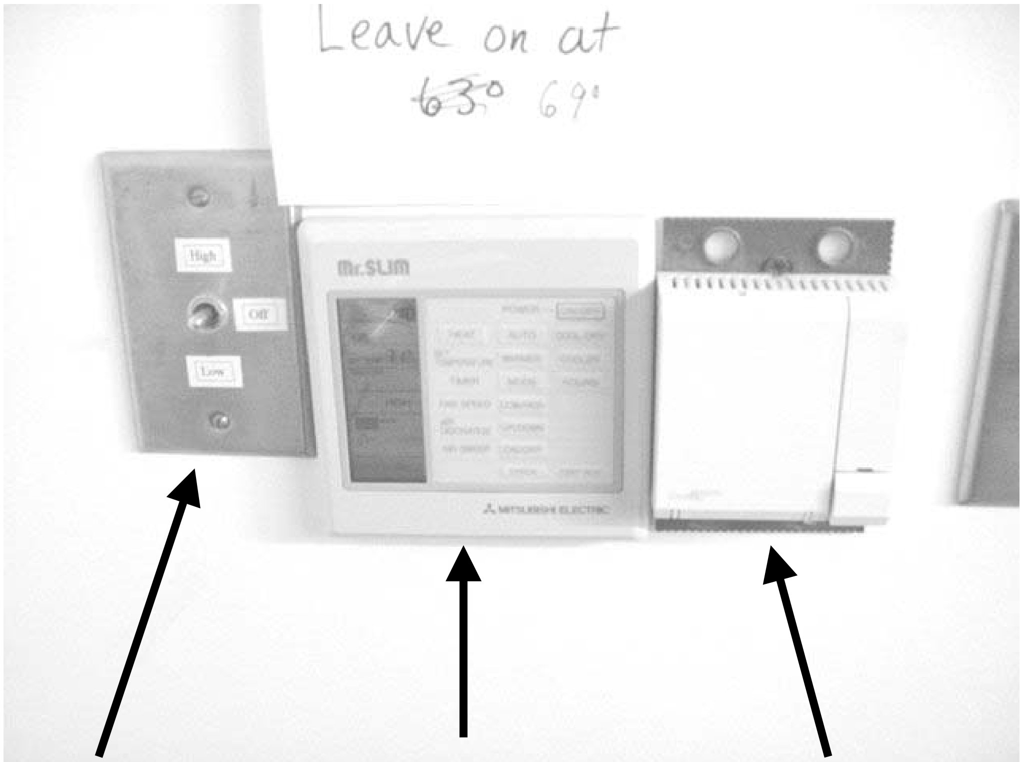
Picture 5

Classroom Exhaust Vent Obstructed by File Cabinet

Picture 6

Wall-Mounted Classroom Exhaust Vent Behind Open Door

Picture 7



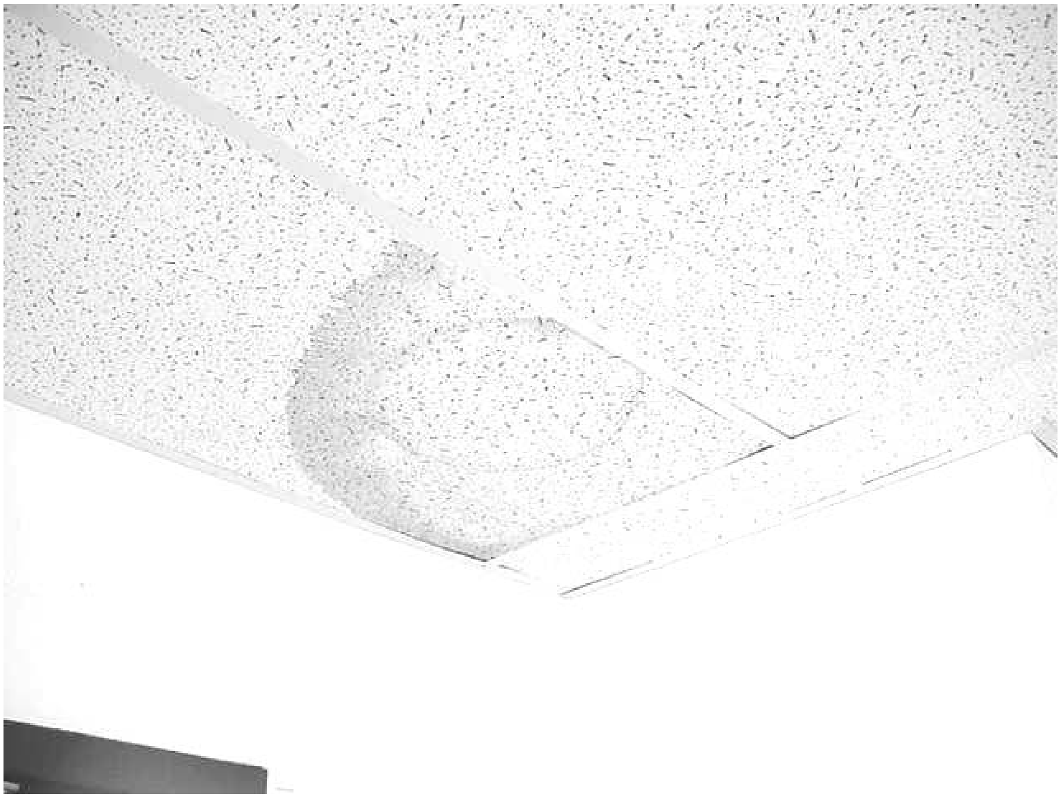
exhaust fan **AC system** **classroom thermostat/univent control**

Ventilation Controls for Science Room/Lab

Picture 8

Sections of GW Removed to Observe Conditions in Wall Cavity

Picture 9

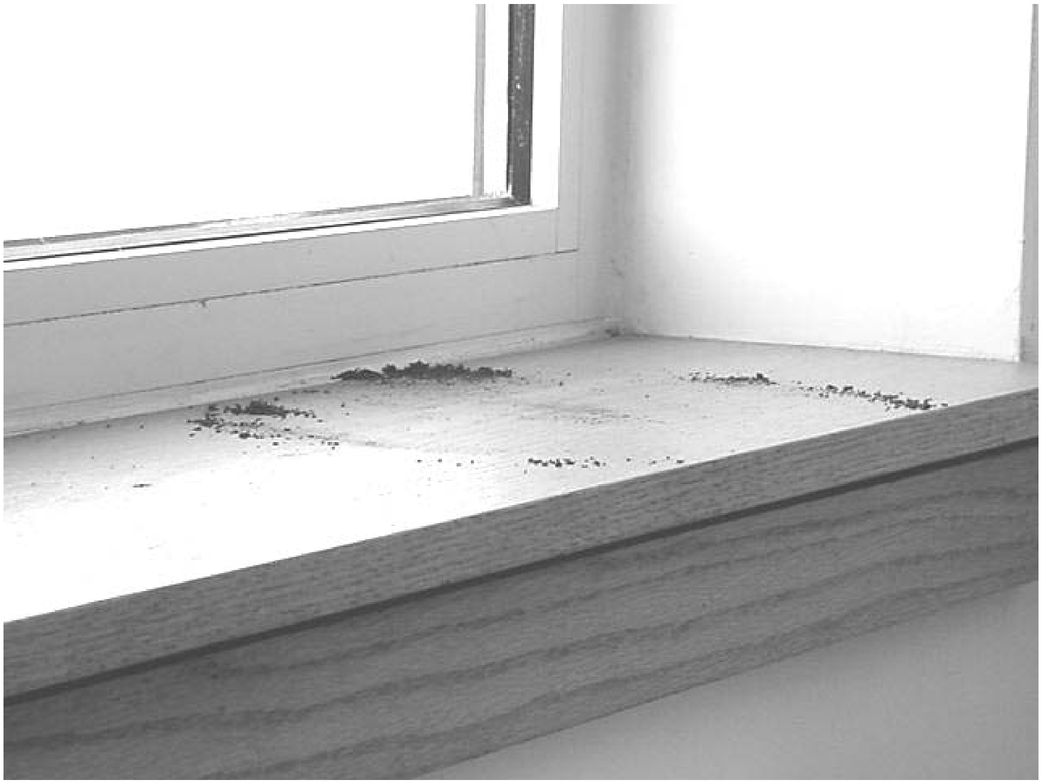


Water-Damaged Ceiling Tile

Picture 10

Plants on Classroom Univent

Picture 11



Potting Soil on Windowsill near Classroom Univent

Picture 12

Water Fountains Installed over Carpeting in Main Hallways

TABLE 1

Indoor Air Test Results – Georgetown High School, Georgetown, MA – December 19, 2001

Location	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation Intake	Ventilation Exhaust	Remarks
Outside (Background)	333	48	30					Clear, cold, sunny
Room 3090	796	70	28	19	Yes	Yes	Yes	Exhaust vent partially obstructed by file cabinet, door open
Room 3100	721	68	27	0	Yes	Yes	Yes	Plants on univent, door open, 1 water stained CT
Room 3110	1041	67	27	24	Yes	Yes	Yes	Plant/items on univent, potting soil on windowsill, accumulated items, door open, 1 water stained CT, exhaust weak-behind door
Room 3130	958	73	29	24	Yes	Yes	Yes	Exhaust blocked by paper bag, door open
Room 3150	890	71	27	23	Yes	Yes	Yes	Exhaust weak, plant
Room 3180	1017	77	29	24	Yes	Yes	Yes	Exhaust vent by table & chairs, box on univent, 1 water stained CT, door open
Room 3190	1120	71	28	21	Yes	Yes	Yes	Plants
Room 3210	924	68	30	12	Yes	Yes	Yes	Exhaust partially blocked by computer cart, items on univent, door open
Room 3220	969	68	30	14	Yes	Yes	Yes	

*** ppm = parts per million parts of air**
CT = ceiling tiles

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 2

Indoor Air Test Results – Georgetown High School, Georgetown, MA – December 19, 2001

Location	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation Intake	Ventilation Exhaust	Remarks
Room 3120	1374	70	35	23	Yes	Yes	Yes	Heat complaints/morning, 1 water-damaged CT-possible mold growth (near storage cabinet rear)
Room 3040	770	70	28	0	No	Yes	Yes	3 water-damaged CT, door open, A/C-filters dirtyroom 3050
Room 3050	748	70	28	1	No	Yes	Yes	A/C-filter clean
Room 3060	720	70	27	0	Yes	Yes	Yes	
Music Office	370	68	25	0	Yes	No	Yes	
Music Room	348	68	25	0	No	Yes	Yes	
Room 2250	729	68	27	13	Yes	Yes	Yes	
Room 2240	788	68	27	13	Yes	Yes	Yes	Exhaust partially blocked with boxes
Room 2220	1180	69	32	10	Yes	Yes	Yes	Univent deactivated, access panel removed, door open
Hallway								Water fountain over carpeting
Room 2190	938	70	30	1	Yes	Yes	Yes	Univent deactivated, access panel removed, ~17 occupants gone 20 min.,

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TABLE 3

Indoor Air Test Results – Georgetown High School, Georgetown, MA – December 19, 2001

Location	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
								complaints of temperature extremes, plant on univent, book on univent-blocking airflow, exhaust off/weak
Room 2210	1318	69	32	8	Yes	Yes	Yes	Univent deactivated, access panel removed, exhaust vent blocked by bookcase
Room 2150	817	70	29	1	Yes	Yes	Yes	15 occupants gone 25 min., univent off, exhaust off/weak
Room 2140	455	67	24	0	Yes	Yes	Yes	Occupants gone 25 min., univent-grill blocking airflow, exhaust off/weak, cold complaints
Room 2100	1366	71	31	20	Yes	Yes	Yes	Exhaust vent off/weak
Room 2090	1080	71	30	16	Yes	Yes	Yes	Plants
Room 2070	1238	72	30	12	No	Yes	Yes	A/C, 20+ computers
Room 2010	984	72	29	23	Yes	Yes	Yes	~8 plants-1 on carpet, cleaning products, dry erase board, floor fan, door open
Room 2020	1050	71	29	1	No		Yes	18 computers
Room 2060	1046	74	29	14	No			~20 computers, “Mr. Slim”, door open

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TABLE 4

Indoor Air Test Results – Georgetown High School, Georgetown, MA – December 19, 2001

Location	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation Intake	Ventilation Exhaust	Remarks
Room 2040	2703	74	37	20	Yes	Yes	Yes	Univent blocked by desks/bookbags, 3 plants-1 on paper towel, dry erase board
Room 2030	921	73	29	4	Yes	Yes	Yes	Dry erase board, door open
Room 2260	1295	68	30	16	Yes	Yes	Yes	Dry erase board
Media Center	1223	70	32	20+	Yes			~12 plants, 18 computers, photocopier
Room 2162 (off media center)	1222	71	32	0	No		Yes	Mimeograph, duplicating fluid, AV equipment, transparency maker, accumulated items
Media Center Storage Area	1125	71	31	0	No	No	Yes (2)	AV equipment, toner, laminator, periodicals/videos
Room 2161 (Computer Lab)	1255	73	31	13	No		Yes	~20 computers, dry erase board
Room 2163	1094	73	30	1	No		Yes	Exhaust activated by switch, door open
Room 2164	1120	74	29	0	No	Yes	Yes	Exhaust activated by switch-no draw
Server Room	1097	74	29	0	No	Yes	No	Door open, sink, mainframe, accumulated items
Room 2130 (Computer Lab)	1683	74	33	20		Yes	Yes	~22 computers, dry erase board, carpet

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Relative Humidity -	40 - 60%

TABLE 5

Indoor Air Test Results – Georgetown High School, Georgetown, MA – December 19, 2001

Location	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
Room 3160	924	70	30	1	No	Yes	Yes	Occupants gone ~40 min., dry erase board, sinks
Room 3140	1093	69	30	18	No	Yes	Yes	Dry erase board, door open, reported noises from A/C unit in closet
Room 3030 (Teachers' Lunchroom/ Workroom)	823	70	30	~12	No	Yes		Dry erase board, soda machine, toaster, 2 microwave ovens, refrigerator, sink, photocopier, M/W restrooms-exhaust on
Room 3010	907	70	29	1	No	Yes	No	Door open, carpet, accumulated items, van. air freshener
Room 3020	852	70	29	0	No	Yes		Water-damaged CT, door open
Room 3280	1067	69	31	15	Yes		Yes	Floor fan, dry erase board
Music Practice Room 1	471	68	27	0	Yes	No	Yes	Switch activated exhaust
Music Practice Room 2	518	69	28	0	Yes	No	Yes	Switch activated exhaust
Music Practice Room 3	467	68	26	0	No	No	Yes	Switch activated exhaust, door open
Room 3080	641	69	27	17	Yes	Yes		Dry erase board, carpet, 4 plants-no drip pans, floor fan, 1 water stained CT
Room 3070	1282	70	32	17	No	Yes	Yes	3 plants, dry erase board, carpet

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TABLE 6

Indoor Air Test Results – Georgetown High School, Georgetown, MA – December 19, 2001

Location	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
Room 3290	1806	70	35	21	Yes	Yes	No	2 personal fans, carpet, dry erase board
Room 3270	1233	70	30	5	Yes	Yes		2 aquariums, guinea pig, plant, dry erase board, carpet
Room 3260	1061	70	29	14	Yes	Yes	Yes	Papers on univent, exhaust obstructed by cart, dry erase board, carpet, 1 CT ajar
Room 3250	1082	69	31	26	Yes	Yes	Yes	Books/desks obstructing univent, table/boxes obstructing exhaust vent, dry erase board, carpet, 6 plants-with drip pans, 2 personal fans, door open, accumulated items
Room 3240 (Art Room)	905	69	31	1	Yes	Yes	Yes	Occupants gone ~2 hrs., clay items on univent, plant, sink, door open
Women's Restroom							Yes	Floor drain
Auditorium	496	69	26	~32	No			
Room 1330 (Consumer Science)	1433	74	36	23	No	Yes	Yes	Supply and exhaust off, (additional) switch activated exhaust-on/no draw, 4 sinks, 4 stoves-2 elec./2 gas (CO=1), dry erase board, reports of cough
Janitor's Closet 1060								Door open

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TABLE 7

Indoor Air Test Results – Georgetown High School, Georgetown, MA – December 19, 2001

Location	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
Room 1090	660	73	28	2	Yes	Yes		Photocopier, 6 water-damaged CT, 7 plants, dry erase board
Room 1150 (Woodshop)	1090	71	29	12	No	Yes		Block style windows, dry erase board, table saw/table drill
Wood Lab	691	67	28	0	No	Yes	Yes	No occupants ~2 hrs., wood stains on table, spray booth, sander, 2 flammable cabinets-locked, ~16 (55 lb) bags of concrete mix, ext. doors
Janitor's Storage 1130					No		Yes	Exhaust off, door open
Cafeteria	637	66	28	7	Yes			
Room 1320	784	68	31	2	No		Yes	Block style windows-1 broken, switch activated exhaust, chemical storage area-old materials, old refrigerator-poss. Mold, chem. hood-alarm malfunction
Room 1270	652	68	30	0	No		Yes	Block style windows, aquarium
Room 1250	971	67	31	0	No	Yes	Yes	Block style windows-1 cracked, dry erase board
Room 1190	579	67	30	0	Yes	Yes	Yes	Univent off, 4 aquariums-1 with algae growth, ~20 plants, dry erase board
Gym	569	67	30	10	No	Yes	Yes	

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Relative Humidity -	40 - 60%

TABLE 8

Indoor Air Test Results – Georgetown High School, Georgetown, MA – December 19, 2001

*** ppm = parts per million parts of air**
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Comfort Guidelines

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